

RESEARCH, DEVELOPMENT, AND  
TECHNOLOGY TRANSFER GUIDELINES  
FOR THE MONTANA DEPARTMENT OF  
TRANSPORTATION

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*prepared by*

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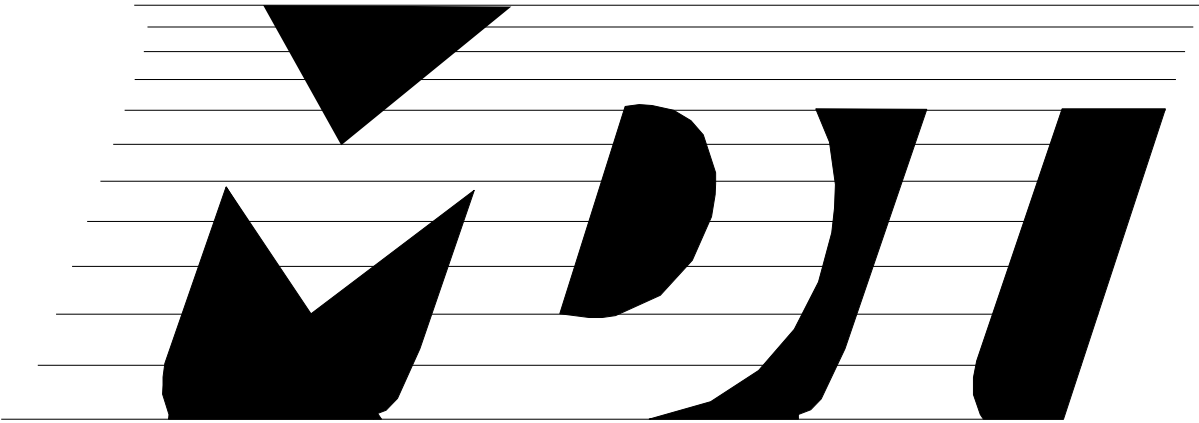
THE U.S. DEPARTMENT OF TRANSPORTATION  
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*June 1997*



RESEARCH PROGRAM



# RESEARCH, DEVELOPMENT, AND TECHNOLOGY TRANSFER GUIDELINES FOR THE MONTANA DEPARTMENT OF TRANSPORTATION

March 2000

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## **SUMMARY**

The Montana Department of Transportation (MDT) conducts research to discover, develop, or extend knowledge needed to operate, maintain and improve the statewide multimodal transportation system. Specific goals include: evaluation and advancement of new technologies, materials and methods; development of design and analysis techniques; and study of current transportation challenges.

The Department's research effort is administered by the Research Management Unit (RMU), which has immediate responsibility for the management and conduct of research. To ensure that research is responsive to the Department's needs, the Research Review Committee (RRC), composed of representatives from the MDT's Divisions and Districts, oversees the total research effort. Individuals possessing knowledge or expertise in a specific area assist as members of technical panels which manage individual research projects.

Additional information may be requested from the:

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## **CHAPTER 1 PURPOSE AND CONTEXT OF MANUAL**

### **1.1 Purpose**

The primary purpose of this manual is to provide an effective MDT research program administered through the RMU. Through the identification of the various research related functions and operational procedures of the MDT, this manual will produce a model of a research management system. The programs, projects, and products generated by the RMU, using the management system, are provided for the ultimate benefit of MDT's customers.

To ensure the effectiveness of the MDT's research process and program, several key objectives are presented in this manual:

- \* determining the usefulness and implementation potential of the research conducted by or through the MDT;
- \* ensuring that research results are incorporated in the MDT's long-term program;
- \* assessing research using project and program accomplishments; and
- \* improving research through the coordination of several disciplines.

### **1.2 Overview**

This manual covers the complete process used by the RMU from program development through program evaluation, including technology transfer and the management requirements needed to maintain an effective research program.

This chapter (Purpose and Context of Manual) defines the need for and provides a brief overview of the contents of this manual.

Chapter 2, Research, Development and Technology Transfer (R, D&T) Interaction details the processes used to increase the interactive nature of the MDT's research program. It also explains the purpose and structure of the research committees.

Chapter 3, Work Program Development, starts the process for the development of the work program. It includes the solicitation and prioritization process, from developing a problem statement request to the screening effort conducted by the research staff and committees. A review and prioritization of the research problem statements leads to the formation of the work program.

Chapter 4, Experimental Projects, explains the incorporation of experimental features into construction and maintenance projects.

Chapter 5, Program Evaluation, lists the elements that give a measure of accomplishment of the research program. These elements include the status of each project, the

techniques for evaluating the entire research program and the details of the peer exchange process using non-MDT personnel.

Chapter 6, Technology Transfer, gives an overview of one of the most important activities in the research process by defining the research partners, project tracking issues and outreach techniques. This includes the input of reports to the Transportation Research Information Service (TRIS) database and the use of TRIS for program development.

## **CHAPTER 2 R, D&T INTERACTION**

### **2.1 Research Partners' Support Development**

As previously stated, the programs, projects and products of the MDT's research program are for the ultimate benefit of MDT's customers. Attaining this objective requires the support of our research partners. Their support can best be achieved by involving them in the process of developing the program and generating the products. This assures that their needs are considered at all times.

The transportation community is broad and multimodal. Research Partners come from the ranks of the MDT, universities, transportation related companies (trucking firms, suppliers, contractors, etc.), transit authorities, tribal authorities, consultants, local governments, regional agencies, other states, FHWA and the public. The partners involved and their level of involvement will be different throughout the research process.

Potential partners will be solicited for research needs. Solicitations will be given the widest possible circulation and exposure to enhance the possibility of receiving a large variety of suggested research topics. Section 3.1, Problem Solicitation, defines this process.

Potential partners may be represented on specific committees, as described in section 2.2, Research Committees Structure. The committee serves as the most formal of the interactive techniques and provides non-MDT institutions the forum to affect policy.

MDT sponsored seminars will introduce broader issues with researchers, users and other experts in a specific field. These seminars will offer presentations and discussions directed to improve the understanding of issues and promote research efforts for the MDT. Principal investigators will conduct a seminar upon the completion of their research projects. Other seminars will be conducted on an irregular basis as needed.

The success of the MDT's research program hinges on our ability to develop strong and lasting interactive relationships with all the beneficiaries of research. The outreach partners and their forums will assist the RMU with program development, consensus building, implementation assistance, technical input and the strengthening of partnerships.

### **2.2 Research Committees Structure**

Researchers seek to effect quality improvement by studying ways to enhance the process, method, or materials presently in use. The change inherent in an enhancement may come easier to the practitioner who is currently doing an effective job with a concerted effort to elicit their input and support. Of the many activities delineated to develop and maintain research partners' support under Section 2.1, Research Partners' Support Development, the committee structure is perhaps the most important.



Through committees, research staff will formally maintain contact with the operating units of the MDT and outside institutions. Meetings are often more effective than a phone call or office visit in that they expose non research members of the committees to a formal interactive process and show that a concerted effort is being made to elicit their support.

When they are properly functioning, committees are useful in providing input for the solicitation of problems, setting priorities for projects, developing the work program, giving advice and general guidance during the process of projects and serving as important conduits for the transfer of research results.

### **2.2.1 Research Review Committee (RRC)**

The committee's membership is broad and includes most of the MDT Divisions, as follows:

- \* Operations Engineer, Engineering Division;
- \* Administrator, Aeronautics Division;
- \* Administrator, Environmental Services
- \* Administrator, Maintenance Division
- \* Administrator, Motor Carrier Services Division;
- \* Administrator, Transportation Planning Division;
- \* Materials Bureau Chief, Engineering Division;
- \* Manager, Research Management Unit, Engineering Division;
- \* Field District Offices Representative; and
- \* Planning and Research Engineer, Montana Division, Federal Highway Administration (*Ex-Officio*).

The Operations Engineer chairs the committee and the RMU Manager serves as its secretary. This committee conducts open meetings approximately once a month in Helena.

The RRC oversees the MDT's total research effort. Its responsibilities include:

- \* advising the RMU;
- \* prioritizing Research Problem Statements (Appendix A) along with the District Engineers/Administrators;
- \* approving new projects and participation in pooled-fund studies;
- \* bolstering the implementation efforts of the technical panels (section 2.2.2) and the RMU; and
- \* approving the annual work program (section 3.6).

### **2.2.2 Technical Panels**

Once a research topic has been characterized as high priority by the RRC, a technical panel is formed to follow that project throughout its duration. Technical panels are typically composed of four to six people with knowledge or expertise, and interest in the specific area of research. Panel members are drawn from the MDT's Division and District offices, as well as from outside the Department. They are also balanced with respect to rank and

viewpoint.

The Technical Panel membership will be chosen by the RMU, with input from other MDT personnel, and will include at least one RMU staff member, who will serve as the panel's secretary. The Technical Panel chairperson will be from the MDT. Technical panels conduct open meetings as often as needed to perform their tasks in a timely fashion. The meeting locations will accommodate the membership.

The Technical Panel's responsibility begins with a review of the literature to determine the need for research and continues with the development of the Research Problem Statement (Appendix A) into a viable research plan. This plan should be formulated using the Research Project Statement form (Appendix B) and should include: what tasks need to be accomplished; how much time and money need to be expended; who should perform the research; and what research products should be delivered.

There are three possible answers to the question "Who should perform the research?". These possibilities are: MDT; Montana University System or other Montana state agencies; and private contractors. Typically, the MDT has not had the staff to perform in-house research. Therefore, most MDT research contracts have been awarded to the Montana University System, due to the MDT's commitment to contribute to the quality and depth of the university educational program. If the Technical Panel chooses to hire a private contractor, the RMU and Technical Panel will jointly write a request for proposal (RFP) and the Technical Panel will evaluate these proposals and choose a contractor based on the MDT's consultant selection criteria, thereby allowing the research to be performed by a private contractor. The specific criteria along with weights, which will be assigned to each criteria, will be indicated in the RFP.

During and following the research, the Technical Panel will monitor research progress by reviewing quarterly, final and any other reports produced by the principal investigator (section 4.1). Finally, the Technical Panel will make implementation recommendations to the appropriate MDT Administrator, through the RRC (Appendix C).

## **CHAPTER 3 WORK PROGRAM DEVELOPMENT**

### **3.1 Problem Solicitation**

Twice a year, the Engineering Division Administrator, through the RMU, solicits research problems from as wide a variety of individuals associated with transportation as possible. This open solicitation enhances the possibility of receiving a diverse sampling of research suggestions.

Suggestions for research are made on Research Problem Statement forms (Appendix A). These forms require a problem title and statement, as well as information on the proposed research, and urgency and expected benefits of the proposed research. These statements provide enough information to allow the RRC to appreciate the significance of the problem, but do not elaborate on details. The Research Problem Statements can be submitted at any time; however, submitters are given a deadline, approximately one month after they are sent out, for each particular solicitation cycle. All submitters will receive an acknowledgment of receipt of their problem statement from the RMU.

### **3.2 Project Prioritization**

The RMU compiles these Research Problem Statements, then presents them to the RRC and District Engineers/Administrators for individual ranking. Each member of these two groups ranks every problem with respect to their overall worth, timeliness and attainability. These individuals also have the opportunity to comment on each problem. Once the RMU receives the individual rankings, RMU staff compiles the comments and average rankings for each problem, with the overall worth equaling 50%, timeliness equaling 30% and the attainability equaling 20% of the total score.

The RRC then reviews the rankings and comments, and selects the high priority topics for that solicitation cycle. These topics are chosen because they address actual concerns of the Department rather than topics which are of specific interest to individual researchers. The RMU will inform all submitters on the status of their topic.

Following the selection of these high priority topics, the RMU forms a technical panel (see section 2.2.2) for each topic. This panel is first responsible for determining the need for research and presenting a complete proposal to the RRC for further and final approval. The importance of the written proposal (Appendix D) cannot be overemphasized; it is the RRC's only means of selecting which studies to fund. The proposal must be concise, clear, and complete. Most importantly, it must convince the RRC that a sound research project will follow. The RRC approves research proposals until funding is depleted for that fiscal year. Other research proposals deemed necessary will be delayed until the beginning of the next fiscal year. For those research proposals approved by the RRC, the Technical Panels will follow that research through completion and implementation.

The RMU may also recommend support of various pooled-fund projects to the RRC. These recommendations will be based on the input from the MDT's Divisions and Districts.

Setting priorities for the problems received in the solicitation process (section 3.1), and through shared funding arrangements (Pooled-Fund projects) and partially supported institutions (NCHRP) allows the RMU to develop a work plan (section 3.6) within its financial limits. This process ensures that the MDT's most important problems will be addressed and advanced for consideration.

### **3.3 Conduct of Research and Implementation of Research Results**

After a research proposal has been approved by the RRC, the RMU develops a formal agreement for the work, which includes the researcher's proposal by attachment. Following the execution of the agreement, the RMU notifies the researcher's institution that work may proceed. The researcher then conducts the research in accordance with the terms of the agreement.

The project's Technical Panel monitors the research throughout its duration. It reviews quarterly progress reports submitted by the researcher, as well as any interim reports specifically required by the agreement. The panel may also visit the research site and interact with the principal investigator as needed. It is the panel's responsibility to ensure the researcher fulfills the terms of the agreement and the research objectives are met. Prior to the conclusion of the research, the panel reviews the draft final report and advises the researcher of any changes which are required.

Upon completion of the study, the research and implementation recommendations will be presented by the principal investigator both in written (final report) and oral (research seminar) format. The Technical Panel is responsible for evaluating the validity of the research and implementation recommendations and reporting its findings. These reports will be made to the MDT Administrators, through the RRC. Following completion of the implementation, the Technical Panel is dissolved (Appendix C).

With the exception of emergency research needs, the Department will follow the process described above and illustrated in Figures 1 and 2 (Appendix C).

### **3.4 Funding**

Federal fuel tax monies made available to the State of Montana under Title 23, U.S.C. (as amended by the 1991 Intermodal Surface Transportation Efficiency Act), with appropriate state matching funds are currently the main source of funding for the MDT research program. The 1991 ISTEA allocates 2% of the total annual transportation disbursement to each state for "State Planning and Research" (SPR) activities. The law further stipulates a minimum of 25% of the SPR funds be reserved for state transportation R, D&T efforts.

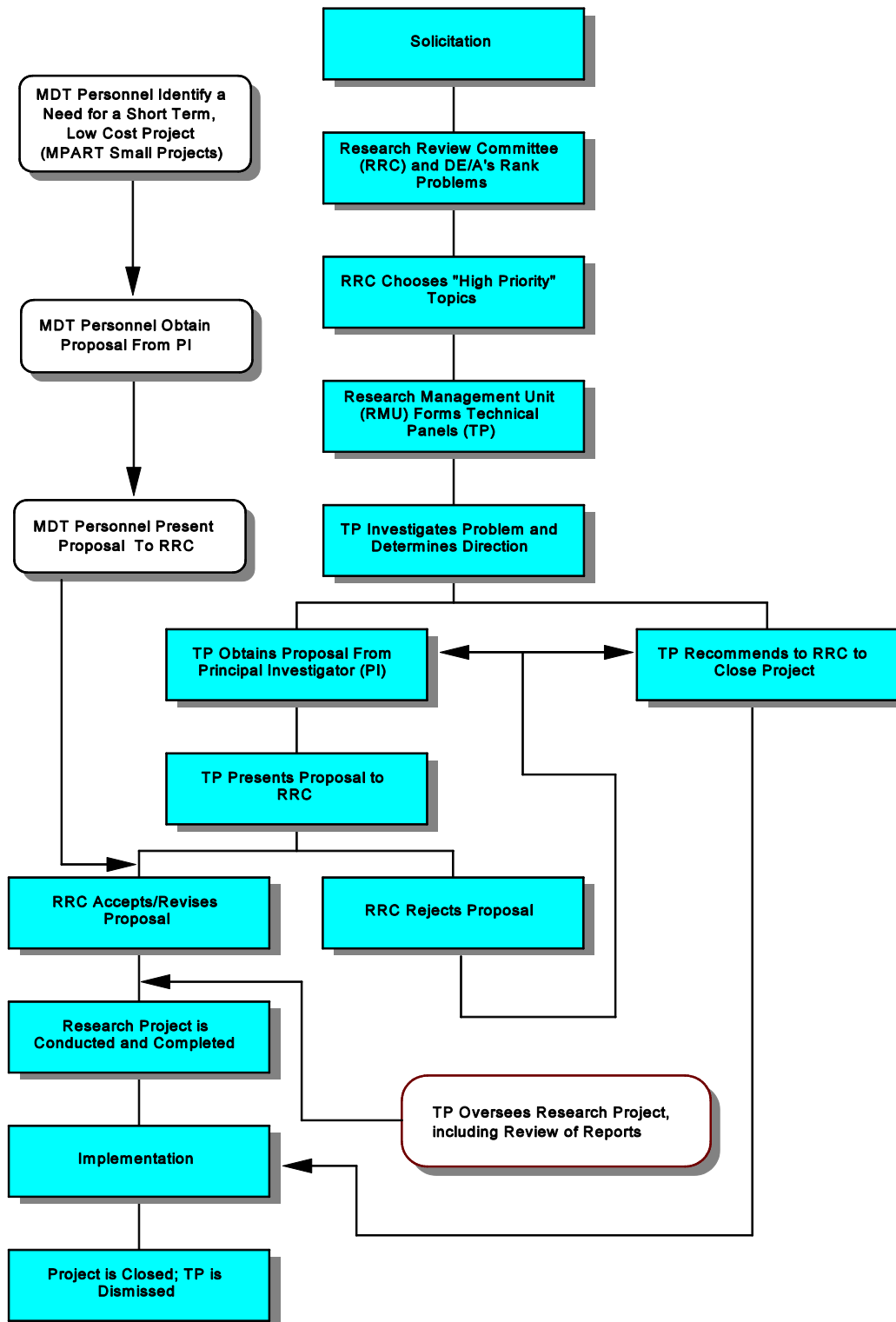
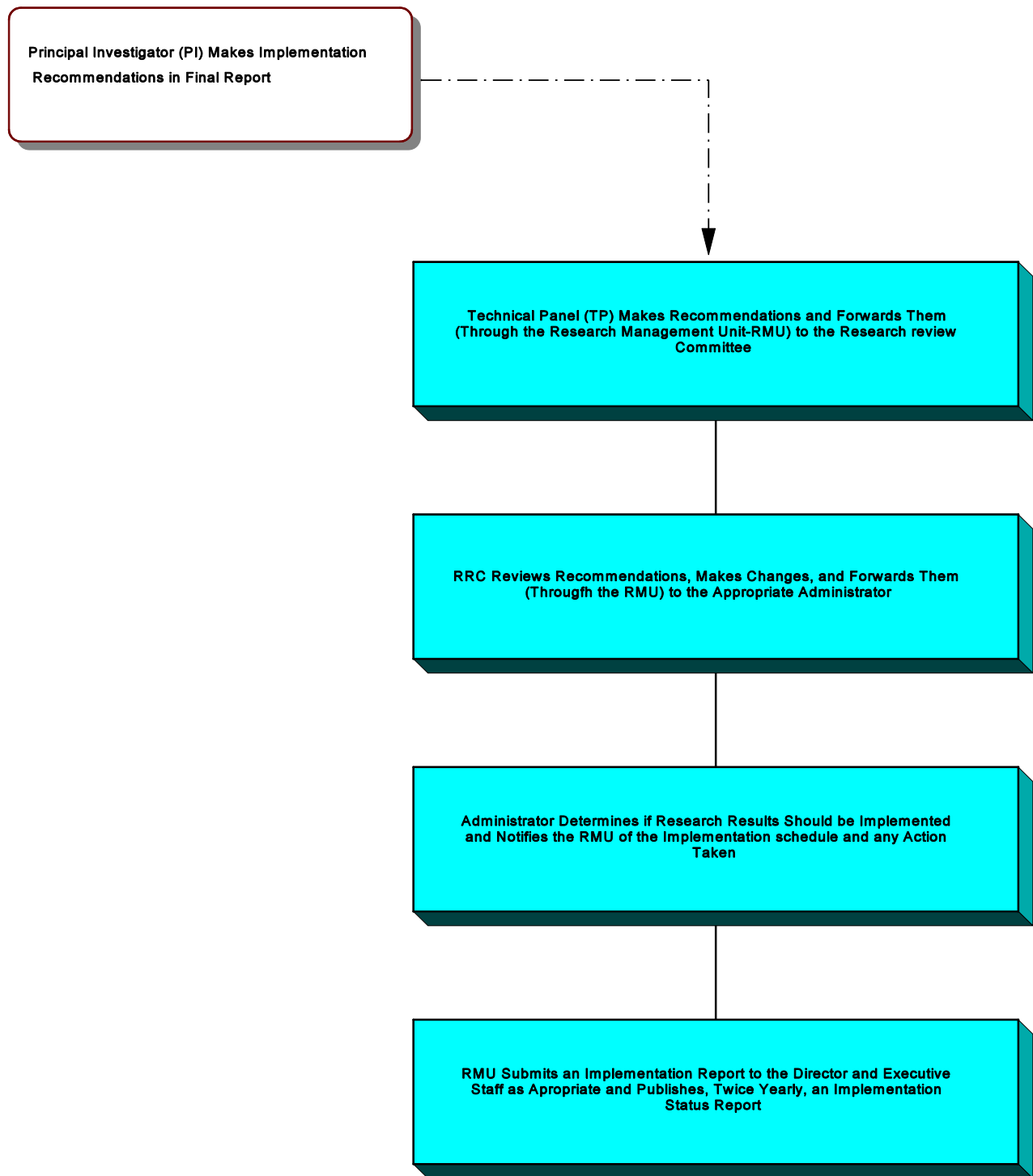


Figure 1: Research Projects



**Figure 2: Implementation**

Funding of the MDT research program is currently augmented through the shared funding of the Western Transportation Institute (WTI), housed at Montana State University (MSU), with the California Department of Transportation (CALTRANS).

The MDT research program may also conceivably be augmented by financial support from other sources, or private business interests. As one example, various other states (South Dakota, Colorado, California, Texas) currently fund specific transportation R, D&T efforts with 100% state funds. The 1991 ISTEA also allows the use of SPR funds to partially support cooperative R, D&T ventures, such as WTI. These cooperative ventures may involve the other state department's of transportation, universities and private entities. Such cooperative ventures are an option for the MDT research program and may be pursued with the advance concurrence of the RRC.

### **3.5 Annual Program and Budget**

The activities of the RMU are concisely and completely described in a single document—the work program. The elements of the work program describe the technical and financial responsibilities of the RMU on an annual basis.

The RMU's work program includes:

- \* summary listing of the major items and a cost estimate for each item;
- \* description of each activity or individual research study to be accomplished during the Federal Fiscal Year (October 1 - September 30);
- \* estimated costs for each activity;
- \* description of any cooperatively funded studies, including national and regional pooled-fund studies and NCHRP contributions; and
- \* financial summaries showing the funding levels and share (Federal, State and other sources) for R, D&T activities.

Following approval by the RRC, the work program is submitted to the Federal Highway Administration (FHWA) Division office for approval and authorization. A copy of the approved work program is forwarded to the regional office and two copies are forwarded to the Associate Administrator for Research and Development.

The Department employs a July 1 fiscal year budget/accounting system in which expenditures and revenues are estimated for the upcoming biennium. In the effort, R, D&T financial projections are developed and submitted by the RMU as part of the MDT Materials Bureau budget. The R, D&T budget typically contains a sizeable line item for "Contingency and New Research", since the precise program configuration is not known at this point in the year.

In broadest terms, the MDT research program is divided into two elements: non-discretionary and discretionary. The non-discretionary element of the program is controlled by the Engineering Division Administrator and covers the costs of fixed items, such as: RMU personnel and overhead; evaluation of experimental projects; and annual payments

in support of the Transportation Research Board (Research Correlation Service) and the National Cooperative Highway Research Program (NCHRP). The discretionary element of the program falls under the purvey of the RRC, which decides the relative importance of the specific R, D&T projects and individual National and Regional Pooled-Fund studies (as initiated under regulations of the U.S. Department of Transportation, Federal Highway Administration) and allocates funds accordingly (section 3.2).



## **CHAPTER 4 EXPERIMENTAL PROJECTS**

The incorporation of experimental features into construction and maintenance projects allows for a vital field evaluation of new materials and methods. This evaluation, if performed well and scientifically based, will allow the MDT to determine the implementation value of these new materials and methods.

The RMU should be involved throughout this process, from the very first discussions indicating the construction of an experimental feature through the final evaluation and reporting to the FHWA as well as the implementation process. RMU involvement will ensure the:

- \* need exists to test specific materials or methods through a TRIS literature search;
- \* appropriate design of experimental features, including the appropriate controls;
- \* proper construction of experimental features and controls through on-site visits;
- \* valid evaluation of performance, based on precise and accurate measurements;
- \* timely annual and final reporting as required by the FHWA; and
- \* appropriate implementation of those experimental features which performed well and were cost effective.

Following the formal evaluation period, the RMU will present its findings including implementation recommendations to the MDT management. If it is determined that further performance information may aid the MDT, the RMU may continue to evaluate experimental projects, as informal experimental projects, following the completion of their formal evaluation period.

Field Research Coordinators (FRC's) from each district have been assigned and will serve as liaisons between the RMU and the districts. The FRC's will be responsible for informing the RMU of any planned experimental features and the dates of construction of these features. They will also assist the RMU in receiving any reports required of field personnel.

### **4.1 Work Plan**

Prior to construction of an experimental feature, the RMU will write and submit a formal work plan to the FHWA for their approval. This work plan should include the following information:

- \* location of project;
- \* construction project number;
- \* title (type) of project;
- \* principal investigator;
- \* statement of objectives;
- \* experimental design;

- \* estimated quantities and costs; and
- \* evaluation schedule.

## **4.2 Construction Report**

Following the construction of an experimental feature, the Engineering Project Manager (EPM) is required to submit a construction report to the RMU. This report should be received by the RMU within 30 days of the completion of construction and should contain:

- \* statement of objectives;
- \* summary of materials and methods;
- \* quantity and cost of experimental feature;
- \* construction problems and a statement of how these problems might have been alleviated; and
- \* date construction of experimental feature was completed.

## **4.3 Initial, Annual and Final Reports**

Initial, annual and final reports are required by the FHWA throughout the formal evaluation period as stated in the work plan.

The initial report consists of a completed FHWA 1461 form and a construction report. This report is due to the FHWA division office by the September 30 immediately following completion of construction.

The annual reports consist solely of a completed FHWA 1461 form to be submitted to the FHWA division office by September 30 of each year during the formal evaluation period.

The final report consists of a completed FHWA 1461 form and a final performance summary of the experimental feature throughout the entire evaluation period. This final performance summary should contain information on the experimental feature as specified in the work plan, including an implementation recommendation. This implementation recommendation should also be presented by the RMU to the MDT management. This report is also due by the September 30 of the final evaluation year.

## **4.4 Product**

Adherence to these procedures will ensure that useable and accurate information, including appropriate implementation recommendations will be obtained through the incorporation and evaluation of experimental features in construction projects.

## **CHAPTER 5 PROGRAM EVALUATION**

### **5.1 Project Level Reporting**

As the research effort focuses on customer benefit, it is conducted with an eye toward implementation. The implementation process is dependent on the exchange of information, which begins with clear, concise, and complete project reports. These reports detail the progress and accomplishments of a research project and are written with the customer in mind. The proper reporting of the projects, will enhance the evaluation of the entire research program.

The principal investigator for all projects will be responsible for writing quarterly progress reports, a final research report, and any oral presentations or interim research reports, if any, as required by the research contract. The Technical Panels are responsible for reviewing all reports resulting from their research.

Quarterly progress reports will include at least the following information:

- \* discussion of each of the major tasks outlined in the work plan and whether they have been completed or are still in progress;
- \* planned and actual time schedule for each of the tasks, including the overall percent complete using the expended versus planned budget;
- \* discussion of financial, staff, equipment and technical problems as they affect the individual tasks, as well as their resolution or attempts at resolution;
- \* discussion of major accomplishments or discoveries and their significance especially with respect to implementation; and
- \* fiscal expenditures.

Copies will be provided to the FHWA Division office, through RRC membership.

Final research reports (one copy suitable for printing and distributing) will include at least the following information:

- \* credit reference to the MDT and FHWA on the cover and title sheets;
- \* Technical Report Documentation Page;
- \* disclaimer statement;
- \* alternative format statement;
- \* table of contents;
- \* summary or abstract, including a brief description of the work and conclusions;
- \* introduction, including the problem, its background and a concise history of research;
- \* work plan, including the experimental research plan, data collection, description of sites and activities and an analysis of the data, all data should be expressed in metric units, with English units following in parentheses ;
- \* findings and conclusions;

- \* recommendations, based on the findings and conclusions, and suggestions for additional research;
- \* implementation Plan, defining the procedure to introduce the results into practice, including suggestions for organizational responsibility and documenting the benefits; and
- \* references or literature cited.

In addition to the Technical Panels, the FHWA Division office will be given the opportunity to review all final reports. Each final report will also be accompanied with a research seminar presented at the MDT by the principal investigator. The RMU will be responsible for the distribution of all final reports (Appendix E).

The quarterly reports are used to monitor progress, and the interim and final reports are the official documentation of the research and form the basis for discussion of the research and presentations to the transportation community. The output of this section is the technical and financial status of a project in cyclical and final report form that is the basis for the implementation effort.

## **5.2 Overall Program Performance**

The expenditure of public funds is subject to careful scrutiny. The profit motive does not exist in the public arena, hence, the programs in the public arena that receive these funds must prove their value through periodic reviews and assessments. After carefully selecting problem statements (section 3.2) and developing the work program (section 3.6), the research effort must follow well defined and scientifically based procedures that ensure unbiased and meaningful results. On an individual project basis, these results are very meaningful. On a program basis, the project's results and implementation efforts should be aggregated to appreciate the cumulative effect of the program.

The implementation efforts of the individual projects were discussed in sections 2.2, 3.3, and 4.1. Summary tabulations of the project efforts will document the progress for the entire program. The tabulations will include implementation discussions and actions:

- \* during the project work plan preparation,
- \* at all project level meetings,
- \* during project field visits, and
- \* at any specific implementation meeting.

In addition to the tabulations listed, all partial or full implementations will be documented. Although a project may have been formally closed out, records of the subsequent implementation successes will be maintained.

The work program is the sum of all activities planned for the year. These activities are primarily projects, technology transfer efforts and technical assistance, seminars and implementation efforts. An annual activities/achievement report will be developed and distributed.

Each funding source used for research has been programmed for the various activities in the work program. In addition, each activity has a specific budget. A record will be kept for both the project level and funding source expenditures.

The individual projects are the most important activities as far as schedules are concerned. Most other activities can be planned throughout the year. The ability to adhere to the schedule for a project is contingent on many factors. The RMU will be in frequent communication with the principal investigators to avert major slippage.

The quarterly report (section 4.1, Project Level Reporting) which reflects the percent complete for each project, and the planned and actual time schedules will also be shown.

The documentation of a successful performance of the research effort is important to continue to receive the management and financial support that it requires. Objective and quantifiable parameters can give the basis for this support. Overall program performance can be measured by a combination of the achievement of implementation and milestones, and a qualified adherence to financial and scheduling limits.

### **5.3 Peer Exchange**

A quality MDT research program depends upon its ability to implement effective and timely solutions to the MDT's problems. It is the execution of the well-planned procedures and processes that ensures the attainment of this objective. One technique designed to improve the quality of the program is a peer exchange of the RMU deliverables through the management system. A panel, with knowledge of state research programs, will bring that expertise to a study of the research process and advance recommendations to enhance its performance.

The exchange team of at least two members will consist of representatives selected from the FHWA, universities, the Transportation Research Board (TRB), the private sector, other agencies and the research units of other states. At least two of the members of the team will be drawn from a preapproved list compiled by the FHWA. The cost of travel of the peer exchange team will be charged against the SPR program and is eligible for 100% federal funding.

The peer exchange team will spend at least two days with RMU staff. Although the items of the agenda may vary due to the needs of the MDT and requests of the exchange team, the basic agenda will cover:

- \* discussion of the RMU's management system, as described in this manual;
- \* scope of the research program, including all the activities in the work program;
- \* examples of a project as it advances through the system, including the solicitation, selection, choice of researcher, project progress and technology transfer activities;
- \* discussion with research partners

- \* review of resources;
- \* review of staff training program;
- \* review of contract process (Appendix F);
- \* review of technology transfer efforts and implementation activities; and
- \* a discussion of recommendations in the form of the processes of other states.

The RMU will arrange a peer exchange at least once every three years to be held at the research office.

### **5.3.1 Exchange Issues**

As previously mentioned, the scope of the peer exchange will depend on the needs of the MDT, with input from the exchange team.

The process for putting together a work program is a description of the early stages of the management system. The process to input the various elements is subject to policy, financial and management considerations. These issues may be discussed with the exchange team.

The magnitude of the research program conducted by contract may warrant a review. If so, the contract research process will be explained to the exchange team, including a listing of all projects that were put into the contract process in the last three years, a listing of all proposals received in the last three years, the results of the proposal review process for each project and the names of all contractors selected.

The satisfactory progress and transfer of information on the projects is essential to a well managed and harmonious relationship with the customer. As a means of assessing this element, copies of each project's most recent cyclical report and recently completed final reports may be made available to the exchange team.

All aspects of the technology transfer effort, as described in Chapter 5, including implementation activities, may be explained to the exchange team. Examples of the efforts made in the implementation of the project results may also be reviewed.

The interactive potential of the RMU is evident in the type of committees and the representation on them. The exchange team may be given details of the committees that interact with research, as defined in Section 2.2, Research Committees Structure. If so, the current membership, minutes from the latest committee meeting and the research process as it relates to the committees will be explained.

The limitations and expectations of the RMU are best defined in terms of the size of staff and budget. The current financial and staff resources, as defined in the work program, may be shown to the exchange team. The current budget appropriation, sources of funds, allocation of funds between activities in the program, organization chart and explanation of the use of staff may also be detailed.

The technical capabilities of the research team can be defined by its educational and practical experience background. The exchange team may be given a listing of training programs available to staff, including state-sponsored courses, research developed courses, FHWA courses and university programs in transportation. In addition, the team may also be told the process that supervisors use to advise staff of the training courses of which they should avail themselves. Finally, a list of all personnel and their degrees, training courses and years of experience may also be made available to the team.

The peer exchange team will write a report on the visit that will cover all aspects of the agenda items. The report will summarize the discussions, itemize the findings and reiterate the recommendations discussed with the RMU. Copies of the report will be filed with the RMU and the Division office of the FHWA.

The peer exchange is a vigorous effort conducted for the benefit of the RMU. It will be accomplished by qualified peers to improve the research process. The recommendations of the team will be discussed with research staff and the MDT management. Every effort will be made to incorporate those recommendations that can improve the quality of the research process. The RMU will write a report on the outcome of discussions of the peer exchange recommendations within the MDT. This report will also be forwarded to the FHWA for further discussion, at their discretion.

### **5.3.2 External Exchange**

Staff of the RMU will be available and encouraged to serve as peer exchange team members. The staff will perform, in another state, the same exchange that was described above in Section 4.3, Peer Exchange. The state holding the peer exchange will be responsible for the travel costs incurred by their reviewers.

### **5.3.3 Product**

The peer exchange process is designed to let the states interact with other states on a formal exchange basis. Staff can both learn from and give guidance to other agencies on the research process. This is an excellent opportunity to participate in and gain the benefits of a nonintrusive review of the MDT's research process.

The process should result in recommendations covering the problem solicitation process, work program, contract research effort, project monitoring, project reporting, technology transfer and implementation efforts.

## CHAPTER 6 TECHNOLOGY TRANSFER

Research may be described as the careful, systematic study to advance knowledge in a specific field, but the crux of the program for the state is in the application of research results. Technology transfer in research goes beyond the use of the results of the research projects conducted by the RMU. Research staff have acquired an expertise in a range of transportation fields. That expertise is continuously in demand by the operating units of the MDT. Further, the field of transportation is dynamic, a fact that compels the research staff to keep the transportation community in Montana abreast of the latest developments.

Everyone benefits from the transportation system, and hence, from research into the system. In section 1.1, Purpose, the ultimate beneficiaries of research were stated to be the MDT's customers. The technology transfer activities of research will be directed to the immediate customer, with the larger community in mind.

The partners of research, as defined in section 2.1, Research Partners' Support Development, are also the beneficiaries of research. Gaining the support of the beneficiaries of research was also discussed in section 2.1. The partnerships formed with MDT operating units, universities, companies, transit authorities, tribal authorities, consultants, local governments, regional agencies, other states, FHWA and the public will require constant renewing. The transfer of technology cannot be accomplished without the concurrence and assistance of these partners.

Research staff will be active participants in the technology transfer activities in the following ways:

- \* the progress of the research projects will be continuously examined to ensure that the deliverables are amenable to implementation;
- \* the results of research projects will be advanced for implementation;
- \* the expertise of the RMU staff will be available to the operating units of the MDT for problem solving;
- \* the research office will maintain a library of transportation publications;
- \* the results of promising research from other agencies and publications will be made available to the MDT's operating units;
- \* information on FHWA Demonstration projects will be disseminated to MDT staff, and analyzed for a potential workshop session;
- \* research staff will be actively involved in the design, installation and analysis of experimental features in construction;
- \* as noted in section 2.1, Research Partners' Support Development, research staff will actively participate in the development of committees, institutional discussions and seminars to involve potential partners in the research process; and
- \* staff will attend important regional and national meetings and disseminate the results to the MDT.

All possible methods of collecting and disseminating information on transportation



improvements will be pursued. The results of this activity will foster implementation, avail the research unit's partners of staff expertise and keep the transportation community apprised of the latest advances in the field.

## **6.1 Transportation Research Information Service (TRIS) Database**

The basis of research support is the information it provides clients. Despite the expertise of the staff, there are many informational requests made of research that require literature searches. An analysis of problem statements and informational requests must consider the literature defining the state of the art of the subject. The TRIS database is the single most comprehensive file of literature on all subjects in the field of transportation.

### **6.1.1 Reporting to the TRIS Database**

The RMU will contribute to this database by updating their projects in a timely manner. Ongoing research activities will be reported quarterly to the TRIS database. The reporting will include the status of existing projects, significant changes to existing projects, the addition of new projects, the completion of projects and significant technology transfer activities. All completed reports will be documented in the TRIS system.

### **6.1.2 Searching the TRIS Database**

A search of a computerized file for information on a subject starts with a selection of the appropriate keywords. If the keywords are too broad in scope, too much information will be returned; it will be very time consuming to siphon that which is important to the search. Conversely, if the keywords are too specific, very limited information may be returned. A selection of keywords should be made after discussing the subject with the client. Only then can the search structure be properly set up. It's important to structure the search so that the information available to the user adequately covers the subject.

A summary of the findings of the search will be developed from the abstracts of the search. This will serve as the basis for defining further study of the subject. If the search is made for a client, a review of the synthesized material with the client should be the most helpful means of deciding follow up exchange procedures. If the search is made as part of the literature review process at the outset of a project, the synthesis will serve as background material for the research.

A study of the abstracts should lead to an in-depth review of some articles. For the more esoteric subjects, this is a necessary step. It could lead to additional keywords and the suggestion that another informational system may have to be accessed.

The TRIS database should provide the RMU with the best possible background on the issue under question and air the results of the agency's research to a broad audience.

## APPENDIX A: RESEARCH PROBLEM STATEMENT

R.M.U. USE ONLY

PROBLEM STATEMENT NO:

DATE OF RECEIPT:



Montana Department  
of Transportation

### STAGE I RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE:

II. PROBLEM STATEMENT:

III. RESEARCH PROPOSED:

IV. URGENCY AND EXPECTED BENEFITS:

V. SUBMITTED BY: NAME \_\_\_\_\_

TITLE \_\_\_\_\_

AFFILIATION \_\_\_\_\_

ADDRESS \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

PHONE NO. \_\_\_\_\_

Note: Submitter may attach continuation sheets if necessary.

## APPENDIX B: SAMPLE RESEARCH PROBLEM STATEMENT

<b>R.M.U. USE ONLY</b>
<b>PROBLEM STATEMENT NO:</b>
<b>DATE OF RECEIPT:</b>



Montana Department  
of Transportation

### STAGE I RESEARCH PROBLEM STATEMENT

- I. PROBLEM TITLE:** Use of Recycled Asphalt
- II. PROBLEM STATEMENT:** Disposal of removed asphalt pavements (either milled or salvaged pavement) has become a problem due to environmental concerns. With the passage of time and the depletion of available acceptable aggregates it becomes more costly to construct flexible pavements.
- III. RESEARCH PROPOSED:** Utilize milled and/or crushed salvaged bituminous pavement materials with different asphaltic material additives (high float emulsions, rapid cure emulsions, etc.) For both wearing courses and non-wearing courses.

Utilize different materials for different applications - low volume maintenance overlays to high volume contractor projects.

Compare cold and hot in-place recycling and central plant material. Also, include use of recycled open-graded friction course (OGFC).

- IV. URGENCY AND EXPECTED BENEFITS:** Some areas are extremely short of acceptable aggregate. We are losing a valuable resource each time we bury or give away removed bituminous surfacing material.

**V. SUBMITTED BY:** NAME Gene Stettler  
TITLE District Engineer  
AFFILIATION Great Falls District - MDT  
ADDRESS BOX 1359  
Great Falls MT 59403  
  
  
PHONE NO. 727-4350

Note: Submitter may attach continuation sheets if necessary.

**APPENDIX C: RESEARCH PROJECT STATEMENT**  
**MONTANA DEPARTMENT OF TRANSPORTATION**  
**RESEARCH PROJECT STATEMENT**

Title: \_\_\_\_\_

Problem Description: \_\_\_\_\_

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Urgency: \_\_\_\_\_

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Literature Summary: \_\_\_\_\_

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Are research results already available? \_\_\_\_\_ If so, how can MDT implement these results? \_\_\_\_\_

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In summary, does research need exist?\_\_\_\_\_ Explain:\_\_\_\_\_

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Research Objectives:

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_
- 4) \_\_\_\_\_
- 5) \_\_\_\_\_
- 6) \_\_\_\_\_

Research Tasks:

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_
- 4) \_\_\_\_\_
- 5) \_\_\_\_\_
- 6) \_\_\_\_\_
- 7) \_\_\_\_\_
- 8) \_\_\_\_\_
- 9) \_\_\_\_\_
- 10) \_\_\_\_\_

Potential Implementation: \_\_\_\_\_

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\_\_\_\_\_

Budget Estimate:\$\_\_\_\_\_

Study Duration: \_\_\_\_\_ months

MDT Involvement:\_\_\_\_\_

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Recommendation:

☐\_No Research

☐\_In-house Research

☐\_Contract Research

☐\_NCHRP

☐\_Nat. Pooled Fund

☐\_Reg. Pooled Fund

Explain:\_\_\_\_\_

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Technical Panel

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## **Instructions:**

These instructions are intended to help technical panels develop Research Project Statements. Each panel should complete a statement form cooperatively at its first meeting.

### **Title**

State the title of the research study. The title should be brief, but should convey the general idea of the study. You are free to modify the title listed on the original problem statement(s).

### **Problem Description**

Describe the problem which appears to require research. Identify the nature of the problem, what factors might contribute to the solution, what aspects of the problem may affect the result(s). Try to be as specific as our knowledge permits.

### **Importance**

Describe the importance of this study. What real world costs are associated with the problem? Will the problem continue unless research is done? Does future MDT activity depend upon this research? What savings in money or time might result from the research? Can the research be postponed to another year? Would the research be completed prior to a major implementation (timeliness)?

### **Literature Summary**

Briefly summarize information available from previous research. Is this problem widespread? Do others consider it to be important? What work has been done to solve the problem? Would that research apply to our problem? How successful was it?

### **Results Already Available**

If prior research is sufficient to provide a solution to the problem, recommend what MDT can do to adopt these results. Be specific. Identify what would have to be done, who would have to do it, how much it would cost, and what it would accomplish.

### **Research Need Evaluation**

Recommend whether research is needed based upon your evaluation so far. Briefly explain your decision. If research is needed, you will develop specific recommendations for the study on page 2 of the Research Project Statement.

### **Research Objectives**

Define the purpose of the research—that is, what should it accomplish. At this point, focus on the goals of the research, but not the details of how they will be achieved. Make sure the goals respond to the needs outlined in the problem description, so the research will actually produce a solution.

## **Research Tasks**

In this section, list the specific tasks which you think a researcher will need to perform to meet the objectives listed above. Be specific enough to ensure that the work gets done, but not so specific that no room for innovation is left. The tasks should be clear, so a researcher can intelligently estimate how much effort they will entail. Typical tasks include:

1. Literature review
2. Data collection
3. Analysis
4. Interim reports
5. Field tests
6. Final report

## **Anticipated Implementation**

Describe how you think the MDT could implement the results. Are specification changes anticipated? Procedural changes? Organizational changes? New designs or materials?

## **Budget Estimate**

Estimate the cost of the proposed research, and its duration. Consider only the cost of the research, not of associated construction. Your estimates will be somewhat arbitrary, but nonetheless will very likely become the actual project limits. Use your best judgement.

Federal Highway Statewide Planning and Research (SPR) funds will be used.

## **MDT Involvement**

Identify any necessary Departmental involvement in the research. Consider construction costs, traffic control, materials sampling, heavy vehicles and crew, information or anything else that might be required. Estimate costs.

## **Recommendation**

Recommend what action you feel is appropriate. The alternatives and their criteria are listed below. Your recommendation will be the main factor in the Research Review Committee's consideration of the study. Whatever your recommendation, offer some explanation.

1. No Research: You may recommend that no research be done (even if a research need apparently exists) if:
  1. Insufficient need exists
  2. Cost outweighs benefits
  3. Success is unlikely



2. In-house Research: Recommend in-house research if:

1. Need exists
2. Benefits justify cost
3. Topic is internal to the MDT
4. MDT personnel are available
5. MDT expertise is available
6. Heavy MDT involvement will be required
7. Outside opinion is not required

3. Contract Research: Research should be done by a consultant (including the academic community) if:

1. Need exists
2. Benefits justify cost
3. Outside perspective is desirable
4. Outside expertise is required
5. MDT manpower is not available
6. Heavy MDT involvement is not needed
7. Topic involves other government agencies

4. National Cooperative Highway Research Program: The NCHRP sponsors contract research on topics of general interest to states. Problem statements are solicited annually. Approximately 10% of those solicited are funded. Recommend an NCHRP study if:

1. Need exists
2. Benefits justify cost
3. National interest is likely
4. There is high probability of success
5. Costs are high (>\$100K)
6. Waiting 1-2 years won't matter

5. National Pooled-Fund Study: When many states have an interest in a research study, it is possible to pool funds (through FHWA) for contract research. Recommend a national pooled fund study if:

1. Need exists
2. Benefits justify costs
3. National interest is likely
4. There is some likelihood of success
5. Costs are high (>\$100K)
6. Waiting 1-2 years won't matter

6. Regional Pooled-Fund Study: Regional pooled fund studies are similar to the national kind, except that the study usually addresses topics of regional interest. Study costs are usually, but not always, lower than for national studies. Recommend a regional pooled fund study if:

1. Need exists
2. Benefits justify costs
3. Regional, but not national, interest exists

4. There is likelihood of success
5. Costs are moderate to high
6. Waiting 1-2 years won't matter

### **Technical Panel**

List the names of technical panel members.

## **APPENDIX D: IMPLEMENTATION OF RESEARCH RESULTS**





## **APPENDIX E: PREPARATION AND SUBMISSION OF PROPOSALS**

The MDT RMU solicits research proposals from colleges, universities, research institutes, professional consultants, government agencies and others who possess extensive, demonstrated capability and experience in the subject areas.

### **Proposal Submission**

Proposers must submit their proposals to the RMU. Proposals must arrive at the RMU on or before the time and date specified in the Request for Proposal (RFP), if applicable. Proposals arriving after the deadline may be considered in later time frames.

The RMU will acknowledge receipt of proposals. All proposals submitted become the property of the MDT. The MDT reserves the right to use all information presented in any proposal, unless it is annotated as proprietary. Selection or rejection of a proposal does not affect this right.

The MDT reserves the right to reject any and all proposals submitted. It may, under certain conditions, negotiate with a proposer to address specific weaknesses in a submitted proposal.

The MDT is not responsible for any costs incurred by potential researchers, prior to the execution of a contract. Furthermore, costs of developing the proposal are not a reimbursable item to the successful research agency.

### **Proposal Organization**

The research proposal should be a well-prepared document that defines the research problem and objectives; provides a detailed work plan for achieving the objectives; and indicates how the research findings are expected to be used. Proposals should provide a straightforward description of the researcher's ability to meet the requirements of the RFP, if applicable.

The following instructions are intended to help researchers prepare a proposal which will be accepted with a minimum of changes. Proposals must comply with these instructions to be considered. Failure to comply will seriously jeopardize the proposal's chances of selection.

#### **Title Page**

The proposal cover should include the information shown on Figure 3.

#### **Table of Contents**

On a separate page, list the proposal's sections and page numbers.

#### **Problem Statement**

Concisely express your understanding of the problem presented. If the proposal is in response to an RFP, do not repeat the wording of the RFP; rather, demonstrate your insight into the problem.

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**A Proposal For:**  
**Bridge End Backfill Study**

**Submitted by**  
**(your name)**  
**(your affiliation)**  
**(your address)**  
**(city, state, zipcode)**

**Submitted to**  
**MONTANA DEPARTMENT OF TRANSPORTATION**  
**RESEARCH MANAGEMENT UNIT**  
**2701 PROSPECT AVENUE**  
**HELENA, MT 59620**

**(date)**

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**Figure 3: Sample Proposal Title Page**

## **Background Summary**

Include background information on the research topic. Summarize the findings of a preliminary literature search and state the relationship of the proposed study to prior research. The summary should reveal your understanding of underlying principles and should clearly indicate your appreciation of the problem.

The importance of this part of the proposal should not be underestimated. A comprehensive background summary ensures that all aspects of the research topic have been adequately considered so new research can build upon prior work rather than duplicate it.

## **Objectives**

State the technical objectives of the study. Explain and justify any deviations from the objectives listed in the RFP, if applicable.

## **Benefits**

Identify potential benefits expected from the research. Describe how the research results can be used, and by whom, to improve transportation practice. Possible benefits are:

- \* cost savings (both the MDT and the general motoring public);
- \* increased safety;
- \* improved service; and
- \* improved procedures.

## **Research Plan**

Describe how the objectives will be achieved through a logical and innovative plan. Use the task descriptions given in the RFP, if applicable, as a basis for developing the research plan. Specifically identify the tasks which will be performed. Explain and justify any deviations from the tasks listed in the RFP, if applicable.

The plan should also describe the technical basis of the research. Describe the following, as appropriate:

- \* principles of theories to be used;
- \* significant variables to be tested;
- \* analytical and statistical procedures;
- \* experimental and testing procedures;
- \* evaluation criteria;
- \* inspection and survey methods;
- \* controls to be used; and
- \* material, procedure or device development.

The plan should be complete, providing the greatest level of detail that the researcher's understanding of the problem permits.

## **Products**

List the products which will be delivered during the research project. Deliverables might include:

- \* reports;
- \* computer programs;



- \* manuals;
- \* photographs;
- \* video or other audio/visual materials;
- \* physical models; and
- \* databases.

Unless directed otherwise in the RFP, if applicable, always include the following items as products:

- \* brief quarterly progress reports;
- \* draft final report; and
- \* final report, (one copy suitable for printing and distributing).

## Implementation

Describe how the research results can be applied by the MDT to improve its practice. Include the following:

- \* Describe the form in which the findings may be reported, such as a mathematical model, a laboratory test procedure, or a design technique. Describe these results in terms of the practicing engineer or administrator.
- \* Identify who would logically be responsible for applying the research results, such as the American Association of State Highway and Transportation Officials (AASHTO), the FHWA, the MDT, or a particular office within MDT.
- \* Identify specific standards or practices which might be affected by the research findings, such as AASHTO or MDT specifications, MDT policies and procedures, legislation or fiscal requirements.
- \* If findings will not be suitable for immediate application at the conclusion of the research project, indicate what further work might be necessary.

It is understood that the actual research may produce unanticipated findings, making changes in the implementation plan necessary. This is acceptable. The proposal selection, however, will be greatly influenced by the practicality and direction of the implementation plan presented in the proposal.

## Time Schedule

Provide a bar chart or other graphical presentation illustrating the scheduling of the major research tasks on a monthly basis (Figure 4). Always allow twenty (20) days for the MDT review of draft reports.

Task Description Month	0	3	6	9	12	15	18	21	24
1. Field Surveys	*****		***	*****	***				
2. Literature Review	*****								
3. DOT Interviews	*****								
4. Field Tests	****	****	****	****	****				
5. Observe New Construction	*****					*****			

6. Analyze Cost Effectiveness	*****						
7. Develop Recommendations	*****						
8. Prepare Reports	*	*	*	*	*	*	*****

Figure 4: Sample Task Time Schedule

## Staffing

Include pertinent background information for principal investigators and other team members significantly participating in the project. Describe how academic, professional and research experiences relate to the project. Include a summary of past accomplishments in the same or closely related problem areas.

Provide a table showing the number of person-hours (not percentages of time) which will be devoted to each task by research team members, as illustrated in Figure 5. List the names of principal investigators and other key professionals who will be involved. Support personnel may be identified by classification.

Name of Principal Professional							
Employee or Support Classification	Role in Study Task	1	2	3	4	5	Total
Professor A	Principal Investigator	20	30	10	0	10	70
Professor B	Co-Principal Investigator	15	25	20	20	0	80
Graduate Student 1	Field Testing	10	15	5	10	10	50
Graduate Student 2	Analysis	10	15	5	15	5	50
Administrative Staff	Administrative Support	5	5	5	10	5	30
Clerical Staff	Report Publication	5	10	5	10	20	50
TOTAL		65	100	50	65	50	330

Figure 5: Sample Breakdown of Person Hours

List current commitments to other work in sufficient detail to permit assessment of the researcher's ability to meet the proposal's commitments. Include a statement that the level of effort proposed for principal and professional members of the research team will not be changed without written consent of the MDT.

## Facilities

Describe the facilities available to accomplish the research. Indicate equipment which is necessary for completion of the research and specify any restrictions on its use. Specify any equipment which is necessary but not currently on-hand. If additional equipment is to be purchased with project funds, identify it in the budget estimate.

## MDT Involvement

Describe any assistance which may be required from the MDT. Include such items as:

- \* traffic control;

- \* construction;
- \* highway maintenance;
- \* drilling and sampling;
- \* access to transportation facilities;
- \* access to written information or databases; and
- \* interviews.

Estimate quantities as well as possible.

## Budget

Show the estimated cost for the entire research project by both the federal and state fiscal years, as illustrated by Figure 6. The federal fiscal year runs from October 1 to September 30 and the state fiscal year runs from July 1 to June 30.

PROPOSED BUDGET*					
Item	Federal Fiscal Year	95	96	97	TOTAL
Salaries		6,000	4,000	4,000	14,000
Fringe Benefits		900	600	600	2,100
In-State Travel		750	500	800	2,050
Out-of-State Travel		0	0	0	0
Equipment Purchase		1,000	0	0	1,000
Expendable Supplies		350	250	300	900
Subcontracts		0	0	0	0
Overhead/Indirect Costs		2,400	1,600	1,600	5,600
Computer Time		0	0	0	0
Report Publication		0	0	400	400
TOTAL COSTS		\$11,400	\$6,950	\$7,700	\$26,0150

Figure 6: Sample Budget by Fiscal Year

\* Please note, the Proposed Budget example as presented in Figure 6, only shows the federal fiscal year. A duplicate budget must be produced for the state fiscal year.

Each Request for Proposal lists "Funds Available." This amount represents what MDT feels the research topic merits and what level of funding should be necessary to complete the work. Proposers should set the scope and depth of study to be consistent with this level. Because of budget constraints, additional funding is highly unlikely. No budget extensions should be anticipated.

## APPENDIX F: REPORT DISTRIBUTION

INSTITUTION	NUMBER OF COPIES
National Technical Information Service, Room 303F 5285 Port Royal Road Springfield, Virginia 22161	10
University of California TRISNET Repository Institute of Transportation and Traffic Engineering Berkeley, California 94720	2
Northwestern University TRISNET Repository Transportation Center Library Evanston, Illinois 60201	2
Transportation Systems Center TRISNET Repository Kendall Square Cambridge, Massachusetts 02142	2
Department of Transportation Library 400 7th Street, SW. Washington, D.C. 20590	2
Transportation Research Board Library 2101 Constitution Avenue Washington DC 20418	2
FHWA Divisional and Regional Offices Planning and Research Coordinator Federal Highway Administration 301 South Park St., Drawer 10056 Helena, MT 59626-0056	3
FHWA Associate Administrator for Research and Development (HRD-10) Federal Highway Administration 6300 Georgetown Pike McLean VA 22101	5
Montana State Library Documents Section 1515 E. Sixth Ave. P.O. Box 201800 Helena, MT 59620-1800	9
MDT Districts and Areas	11

Reports are also distributed to all the states and within the MDT.